

PCT/EP2019/070505

## CLAIMS

1. A soil measuring method which uses a soil measuring apparatus to measure properties of a soil, including the steps of:

acquiring measurement data from a soil sensor based on

5 information related to at least the type of soil of a measurement site and the water content contained in the soil; and

then inputting said acquired measurement data into a model determined based on information related to said type of soil and the water content in order to calculate soil properties.

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2. A soil measuring apparatus, comprising:

detecting means which acquires prescribed measurement data from a soil of a measurement object; and

15 measurement information processing means which calculates prescribed soil properties based on said measurement data acquired by said detecting means;

wherein a model for processing by said measurement data and said measurement information processing means is determined based on information related to the type of soil of a measurement site and 20 the water content contained in the soil.

25 3. The soil measuring apparatus of Claim 2, further comprising a soil measurement assisting function which determines said model and measurement conditions that include the measurement data to be used, and establishes said measurement conditions and said model in said detecting means and said measurement information processing means.

4. The soil measuring apparatus of Claim 2 or Claim 3, further comprising map creating means which creates a soil map based on soil properties outputted from said measurement information processing means and position information.

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5. A recording medium which can be read by a computer and which stores a soil measurement assisting program that includes commands for the computer to execute:

a process which establishes a model that is determined based  
10 on at least the type of soil of a measurement site and information related to the water content contained in the soil; and

a process which receives measurement data from a soil sensor, and calculates prescribed soil properties from the received measurement data based on said established model.

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6. A soil measurement assisting method in an assisting device for a soil measuring apparatus which measures properties of a soil, including the steps of:

preparing storage means for storing soil measurement data  
20 correlated with at least the type of soil, information related to the water content contained in the soil, a model for calculating soil properties, and measurement conditions for obtaining measurement data that will be inputted into the model;

acquiring at least the type of soil of a measurement site, and  
25 information related to the water content contained in the soil; and

then accessing said storage means based on the acquired said type of soil and the information related to said water content, reading out the corresponding measurement conditions and model, and outputting said read out measurement conditions and model.

7. A soil measurement assisting method in an assisting device for a soil measuring apparatus which measures properties of a soil, including the steps of:

- 5 preparing storage means for storing soil measurement data correlated with at least the type of soil, information related to the water content contained in the soil, and measurement conditions for obtaining measurement data that will be inputted into a model for calculating soil properties;
- 10 acquiring at least the type of soil of a measurement site, and information related to the water content contained in the soil; and then accessing said storage means based on the acquired said type of soil and the information related to said water content, reading out the corresponding measurement conditions, and
- 15 outputting said read out measurement conditions.

8. A soil measurement assisting method in an assisting device for a soil measuring apparatus which measures properties of a soil, including the steps of:

- 20 preparing storage means for storing soil measurement data correlated with at least the type of soil, information related to the water content contained in the soil, and a model for calculating soil properties;
- 25 acquiring at least the type of soil of a measurement site, and information related to the water content contained in the soil; and then accessing said storage means based on the acquired said type of soil and the information related to said water content, reading out the corresponding model, and outputting said read out model.

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9. A soil measurement assisting device for a soil measuring apparatus which measures properties of a soil, comprising:

storage means for storing soil measurement data correlated with at least the type of soil, information related to the water content contained in the soil, a model for calculating soil properties, and measurement conditions for obtaining measurement data that will be inputted into the model;

determining means which acquires at least the type of soil of a measurement site and information related to the water content contained in the soil, accesses said storage means based on the acquired said type of soil and the information related to said water content, and determines the corresponding measurement conditions and model; and

means for outputting said read out measurement conditions and model determined by the determining means.

10. A soil measurement assisting device for a soil measuring apparatus which measures properties of a soil, comprising:

storage means for storing soil measurement data correlated with at least the type of soil, information related to the water content contained in the soil, and measurement conditions for obtaining measurement data that will be inputted into a model for calculating soil properties;

determining means which acquires at least the type of soil of a measurement site and information related to the water content contained in the soil, accesses said storage means based on the acquired said type of soil and the information related to said water

content, and determines the corresponding measurement conditions; and

means for outputting said read out measurement conditions determined by the determining means.

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11. A soil measurement assisting device for a soil measuring apparatus which measures properties of a soil, comprising:

storage means for storing soil measurement data correlated with at least the type of soil, information related to the water content contained in the soil, and a model for calculating soil properties;

determining means which acquires at least the type of soil of a measurement site and information related to the water content contained in the soil, accesses said storage means based on the acquired said type of soil and the information related to said water content, and determines the corresponding model; and

means for outputting said read out model determined by the determining means.

20 12. The soil measurement assisting device of any one of Claim 9 through Claim 11, further comprising a type-of-soil detecting means which calculates said type of soil based on measurement data obtained by measuring the soil of a measurement object, and supplies the calculated type of soil to said determining means.

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13. The soil measurement assisting device of any one of Claim 9 through Claim 12, further comprising a water content information detecting means which calculates information related to said water content based on measurement data obtained by measuring the soil

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of a measurement object, and supplies the calculated water content information to said determining means.

14. The soil measurement assisting device of any one of Claim 9 through Claim 13, further comprising a water content information detecting means which calculates information related to said water content based on measurement data obtained by measuring the soil of a measurement object and the rough type of soil prescribed from the clay content of the soil of the measurement object, and supplies the calculated water content information to said determining means.

15. The soil measurement assisting device of any one of Claim 9 through Claim 14, wherein said type of soil is calculated from a data base that stores previously carried out measurements.

16. A soil measurement assisting method in an assisting device for a soil measuring apparatus which measures properties of a soil, comprising the steps of:

20 preparing storage means which stores soil measurement data correlated with information related to optical properties of the soil, information related to chemical components of the soil, and a model for calculating soil properties;

acquiring at least information related to optical properties of a measurement site;

25 then accessing said storage means based on the acquired said information related to optical properties, and reading out a corresponding model; and

then, acquiring information related to chemical components of the soil at a prescribed site;

wherein said model is compensated based on said information related to chemical components.

17. A recording medium which can be read by a computer and which  
5 stores a soil measurement assisting program that includes commands for the computer to execute:

a process which acquires at least the type of soil of a measurement site, and information related to the water content contained in the soil,

10 a process which, based on the acquired said type of soil and said information related to the water content, accesses a storage region that stores at least the type of soil, the information related to the water content contained in the soil, a model for calculating soil properties, and measurement conditions for acquiring measurement data which will be inputted into the model, and then reads out the corresponding measurement conditions and model; and

15 a process which outputs said read out measurement conditions and model.

20 18. A recording medium which can be read by a computer and which stores a soil measurement assisting program that includes commands for the computer to execute:

a process which acquires at least the type of soil of a measurement site, and information related to the water content  
25 contained in the soil,

a process which, based on the acquired said type of soil and said information related to the water content, accesses a storage region that stores at least the type of soil, the information related to the water content contained in the soil, and measurement conditions

for acquiring measurement data which will be inputted into a model for calculating soil properties, and then reads out the corresponding measurement conditions; and  
a process which outputs said read out measurement conditions.

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19. A recording medium which can be read by a computer and which stores a soil measurement assisting program that includes commands for the computer to execute:

a process which acquires at least the type of soil of a

10 measurement site, and information related to the water content contained in the soil,

a process which, based on the acquired said type of soil and said information related to the water content, accesses a storage region that stores at least the type of soil, the information related to 15 the water content contained in the soil, and a model for calculating soil properties, and then reads out the corresponding model; and

a process which outputs said read out model.

20. The recording medium which can be read by a computer according to any one of Claim 17 ~ Claim 19, further comprising a 20 program which executes at least one process from a process which calculates said type of soil based on measurement data acquired by measuring a soil of a measurement object, and a process which calculates said information related to the water content based on 25 measurement data acquired by measuring a soil of a measurement object.

21. A soil measuring apparatus, comprising:

a soil measuring apparatus main body equipped with detecting means which acquires prescribed measurement data from a soil of a measurement object, and measurement information processing means which calculates prescribed soil properties based on said

5 measurement data acquired by said detecting means; and

a soil measurement assisting device which determines, and then outputs to said soil measuring apparatus main body, the type of soil of a measurement site, a model for carrying out processing by said measurement information processing means based on information related to the water content contained in the soil, and measurement conditions for acquiring measurement data which will be inputted into the model;

wherein data is communicated between said soil measuring apparatus main body and said soil measurement assisting device by a prescribed communication interface.

22. A recording medium which can be read by a computer and which stores at least the type of soil, information related to the water content contained in the soil, a model for calculating soil

20 properties, and soil measurement data correlated with measurement conditions for acquiring measurement data which will be inputted into the model.

23. The recording medium of Claim 22, wherein said soil

25 measurement data is further correlated with the name of a measurement object property.

24. The recording medium of Claim 22, wherein said soil measurement data is further correlated with the measurement method.

5 25. The recording medium of Claim 22, wherein said soil measurement data is further correlated with the name of a measurement object property and the measurement method.

10 26. A recording medium which can be read by a computer and which stores at least the type of soil, information related to the water content contained in the soil, soil measurement data for calculating soil properties, and soil correlation information in a constructed state that enables output.

15 27. An application amount control device which, based on soil property values obtained by measurements carried out in real time while moving through a farmland, controls the amount of substances applied to a soil in order to make the soil property values achieve target values, wherein:

20 the amount of said substances are determined so that said soil property values of the farmland satisfy environmental standards.

25 28. An application amount determining device, comprising:  
a measuring device which measures soil property values in real time while moving through a farmland; and  
a control device which carries out a determination so that said property values of the farmland will satisfy environmental standards when determining the amount of substances to be applied to a soil to

make the soil property values achieve target values based on said measured soil property values.

29. A system, comprising:

5       the application amount determining device of Claim 28; and  
an application device which applies said substances based on the results determined by the control device of the application amount determining device.

10      30. An application amount control method in a control device which sends control commands to an application device which applies prescribed substances to a farmland, comprising the steps of:  
acquiring soil property values obtained by carrying out measurements in real time while moving through the farmland; and  
15      then, based on the acquired soil property values, controlling the amount of substances applied to the soil within a range that makes said soil property values of the farmland satisfy environmental standards.

20      31. A recording medium which can be read by a computer and which stores an application amount determining program that includes:  
a process which acquires soil property values obtained by measurements carried out in real time while moving through a farmland; and  
25      a process which, based on the acquired soil property values, determines the amount of substances to be applied to the soil within a range that makes said soil property values of the farmland satisfy environmental standards held in storage.

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32. A farm working determination assisting system, comprising:  
means for acquiring a soil properties map via communication  
means from the outside;  
a data base system which records said soil properties map in a  
5 data base in correlation with a work history, and which is capable of  
searching a work history suited to the inputted soil properties map;  
and  
means for creating and outputting a work plan based on the  
work history suited to said soil properties map.

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33. A soil model data base control system which accesses a soil  
model data base in which at least the type of soil, information  
related to the water content contained in the soil, soil measurement  
data for calculating soil properties, and soil correlation information  
15 are stored in a constructed state capable of being outputted, and  
which updates and reads out the stored contents, comprising:  
a function which supplies recorded information in response to  
the contents of the request received from a user, and which updates  
the contents.